

STO:

IV.GC.2004.02

Battlespace Gap Definition and Defeat

The Future Force (FF) principles of responsiveness, deployability, agility, and sustainability provide the capability to rapidly concentrate combat power in an operational area. This capability is invariably linked to the force's ability to maneuver within the theater environment. The FCS ORD requires that manned and unmanned ground vehicles be capable of negotiating gaps 1.5- to 4.0-meters wide. Gaps include both natural and manmade obstacles. Overcoming battlespace gaps requires the ability to effectively conduct four tasks: prediction, definition, avoidance, and defeat. The inability to overcome gaps within the theater of operations will significantly impair the FF's responsiveness, agility, and sustainability.

The objective of this program is to develop tools for physically defining the critical parameters of wet and dry terrain gaps and developing expedient defeat concepts for gaps up to 4 meters wide. This program will focus upon natural and man-made gaps in the terrain, such as ravines, tank traps, arroyos, streams, and small rivers. This program will not address other obstacles within the battlespace, such as minefields, NBC obstacles, and human obstacles. This program will adapt existing and emerging sensor technologies to develop novel reconnaissance tools for rapidly assessing the attributes of individual terrain gaps. Existing and emerging technologies, such as automated penetrometers, ground-penetrating radar (GPR), Doppler systems, seismic tools and miniature sensors will be employed to accurately define the critical mobility variables of each terrain gap. The proposed program will develop FCS vehicle-gap mobility algorithms to determine whether the force has the organic capability to breach the gap in-stride or whether additional gap-crossing resources will be required. Adaptive design concepts for defeating gaps will be developed. Advanced materials, such as expandable foam and composite materials, will be evaluated to facilitate concept evaluation. The material behavior, structural properties, and geometry requirements will be used to conduct complex simulations of individual defeat concept performance. These laboratory experiments and simulations will be used to evaluate adaptive design concepts for future prototype development of defeat solutions. The high-fidelity gap detailed gap definition data could be used to update the common operating picture and existing tactical decision aids, such as BTRA.

Identify, evaluate, and down-select available sensor technology for measuring critical gap parameters by FY04 (TRL 3). Develop concepts for rapidly defeating wet and dry terrain gaps with expandable gap-filling materials, advanced composite panels, and platform coupling from TRL 3 to TRL 4 by FY05. FCS Vehicle gap mobility algorithms will be developed from TRL 3 to 5 by FY05 to assess the capability to defeat the gap. Individual prototype reconnaissance sensors will be adapted and refined for deployment on manned/unmanned platforms from TRL 3 to TRL 4 by FY05. Interpretive algorithms from collected reconnaissance data will be developed from TRL 4 to TRL 5 by FY06. Gap defeat concepts will be evaluated using complex simulations by FY06 (TRL 5) to down-select alternatives for future prototype development.

SUPPORTS: MANSCEN, MSBL, PM Combat Mobility Systems, PM Force Projection, FPBLSE, and CENTCOM (J -8)

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Status FY04:New

Approved by _____

IV.GC.2004.02 Battlespace Gap Definition

New FY04

and Defeat

1. What is the problem?

Gaps in the terrain including dry ravines and wet streams present obstacles which impede the assured mobility of the FF. The inability to accurately define and rapidly defeat the gaps less than 4 meters wide within the the battlespace disrupts the UA's decisive maneuver.

2. What are the barriers to solving this problem?

- Gap definition tools are simplistic, lacking required detail
- Existing/emerging sensor technology is immature for this role
- Current maneuver algorithms fail to consider the physics of gaps
- Defeat tools have large footprints & are not C-130 transportable

3. How will you overcome those barriers?

- Adapt penetrometer, Doppler, and sensor technology for precise gap definition on unimproved terrain

4. What is the capability you are developing and where is it described?

- Develop physics-based FCS vehicle gap mobility models
- Defeat tools. Defined in TRADOC Pamphlet 525-66, Force Operating Capabilities: FOC-05-01, Mounted/Dismounted Maneuver; FOC-05-02, Mobility; and FOC-10-03, Provide Assured Mobility.

FCS ORD 4.1.1.3.4 - Mobility: Detect and Defeat Obstacles (ORD 3567) and 2.0.1.1.3 Unmanned Systems - Ability to negotiate 1.5- to 4.0-meter-wide gaps (ORD 3838).

5. What is the product of this STO? (Include M&S)

- Rapid gap definition tools adapted from existing and emerging sensors and automated interpretive algorithms.
- Physics-based models to assess FCS gap breaching ability
- Concepts for expendable gap defeat solutions, such as expandable gap-filling materials and adaptive composite panels.

6. Quantitative Metrics: (Including Affordability)

- Semiautonomous 10 min. recon in lieu of 1 hr 2-man gap recon
- Reduce recon time for major maneuver routes from 7 to 1

7. What is the Warfighter Payoff?:

- Assured Mobility for sustained momentum of the FF
- Reduced reconnaissance times for faster maneuver decisions
- Simulation-based gap defeat concepts to reduce bridging

8. Transition Milestones:

- FY05 Physics-based FCS gap mobility model to BTRA/CJMTK
- FY05 Terrain Gap spatial models - DTSS & CJMTK
- FY06 Advanced technology for gap definition - PM CMS
- FY06 Simulations of gap defeat solutions - PM FCS

9. Endorsements:

MANSCEN - COL Henry Franke 5/03

MSBL- Mr. Vern Lowrey 5/03

PM Combat Mobility Systems - COL Michael Asada 5/03

10. Other STO Attributes:

- Modeling and Simulation Products - SES 6/03
 - Models to interpolate ground conditions within data sets
 - Simulations for gap boundary prediction
 - Simulations to evaluate FCS vehicle gap breaching ability
 - Simulations to compare concepts for gap defeat
- A Technology Protection Plan is not required due to the anticipated reliance upon unclassified COTS technology.
- This is not an international program
- Affordability Metrics:
 - Use of commonly available expendable materials such as ISO containers for temporary bridging reduces requirements for dedicated engineer assets
 - Dual use of gap filling for gap crossing and force protection reduces inventory
 - Reduced manpower for gap reconnaissance



Battlespace Gap Definition and Defeat



SCHEDULE & COST

Tasks	04	05	06
Evaluate Available Sensor Systems Penetrometer, Doppler, GPR, etc.	3	4	
Develop Gap Defeat Concepts Expandable Materials, Composite Panels, etc.	3	4	
Create FCS Vehicle-Gap Breach Models	5 = TRL 5	4	5
Develop Automated Interpretive Algorithms for Sensor Data		4	5
Evaluate Simulated Defeat Concepts			

Purpose:

Provide capability to ...

define the critical parameters of each terrain gap < 4 meters, provide input to existing maneuver decision aids (BTRA), and to develop concepts for defeating dry and wet terrain gaps in the UA beyond the organic self-bridging capability of FCS manned/unmanned vehicles.

Products:

- Integrated rapid gap definition tools will be developed using existing/emerging sensors to define the critical parameters of individual gaps.
- Physics-based algorithms will be developed that evaluate the breaching ability of FCS vehicles based on the physics of the gap and the vehicle.
- Concepts for expendable gap defeat solutions will be developed for rapidly defeating gaps to sustain operational momentum. These products will reside in the UA.

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FY04

FY05

FY06

TRL= 3

Rapid Gap Definition Technology



- Explore Sensors:**
- Penetrometers
 - Doppler Imagery
 - Radar Imagery
 - Seismic Waves

METRICS:

- Develop predictions of FCS maneuver capabilities - no baseline
- Determine required capability of reconnaissance technology

TRL= 4

Expedient Gap Defeat

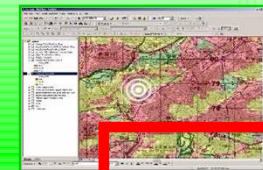


METRICS:

- Develop gap defeat concepts such as foams and inflatable materials
- Conduct limited materials testing for simulation-based evaluations

TRL= 5

Rapid Gap Definition Technology



METRICS:

- Develop automated interpretive algorithms for individual sensor data
- Conduct limited model validations from historical data on similar platforms

TRL= 3

Expedient Gap Defeat



METRICS:

- Identify FCS Maneuver Requirements
- Identify available gap-filling materials technology
- Develop non-material concepts for gap defeat such as structural

TRL= 4

Rapid Gap Definition Technology

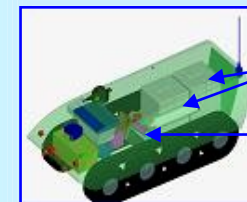


METRICS:

- Develop physics-based protocol for assessing vehicle-gap compatibility - no baseline
- Develop models to improve spatial & temporal predictions of terrain gap dimensions
- Adapt existing/emerging sensor

TRL= 5

Expedient Gap Defeat



Fascines (2)

Compressed Air Storage

METRICS:

- Conduct simulations of gap defeat concepts for feasibility analyses
- Reduce employment times by 60%
- Evaluate concepts for C-130 compatibility